



**Queensland University of Technology**  
Brisbane Australia

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# Improving usefulness of eHealth systems through Information Accountability

Daniel Grunwell, Randike Gajanayake, Tony Sahama

Queensland University of Technology  
Brisbane, Australia

daniel.grunwell@connect.qut.edu.au, g.gajanayake@qut.edu.au,  
t.sahama@qut.edu.au

## I. INTRODUCTION

With the implementation of the Personally Controlled eHealth Records system (PCEHR) in Australia, shared Electronic Health Records (EHR) are now a reality. However, the characteristic implicit in the PCEHR that puts the consumer (i.e. patient) in control of managing his or her health information within the PCEHR prevents healthcare professionals (HCPs) from utilising it as a one-stop-shop for information at point of care decision making as they cannot trust that a complete record of the consumer's health history is available to them through it. As a result, whilst reaching a major milestone in Australia's eHealth journey, the PCEHR does not reap the full benefits that such a shared EHR system can offer.

In this current eHealth environment, healthcare consumers' requirements compete with healthcare professionals' requirements. While consumers want control over their information, healthcare professionals want access to as much information as required in order to make well informed decisions. The goal of an eHealth system therefore must be to balance these competing requirements such that consumers are empowered with the control of their information without hindering the professionals' information needs.

Accountable-eHealth systems are a new genre of shared eHealth records that achieve this critical balance through Information Accountability (IA). IA is a concept that involves using policies to enforce appropriate use through after-the-fact accountability for intentional misuse [1]. Accountable-eHealth systems enable consumers to set information usage rules on their healthcare information and allow professionals to access that information without rigid barriers [2]. The presence of accountability for misuse of information acts as an incentive for consumers to trust the system, as well as both an incentive for healthcare providers to use the system given that the required information is readily available and a disincentive for intentional misuse of information.

Accountable-eHealth systems create an eHealth environment where health information is available to the right person at the right time without rigid barriers whilst empowering the consumers with information control and transparency, thus, enabling a means of reaping the full benefits from a shared eHealth record.

## II. ACCOUNTABLE-EHEALTH SYSTEMS

In an AeH system, consumers are able to set information usage policies on their healthcare providers, in contrast to assigning usage policies to assets. Consumers are able to grant or limit their preferred HCPs' access to certain information, with a central healthcare authority in place to guarantee that the required access levels are always given to the appropriate HCPs without hindering the consumer's privacy.

Transaction logs of all activities of data access and use are kept for holding information users accountable. However, rather than just providing audit logs of information access, an AeH system actively provides notifications of potential breaches of policy to both the patient and the relevant Health Authority, and provide consumers with a user-friendly way to interact with these logs.

If the system detects a possible misuse of a patient's health information, the patient is able to lodge an inquiry asking for the HCP to justify their actions. The HCP is then required to provide an explanation that justifies their need to access the relevant information. If the HCP fails to provide a valid justification, he is held accountable for the ramifications of his actions.

### A. Implementing Accountable-eHealth systems

The implementation of Accountable-eHealth systems involves investigations into the technological aspects such as information usage policy representation and management; socio-technical aspects such as user acceptance, adoption and meaningful use; and legal aspects such as information privacy, transparency, and accountability.

To demonstrate Accountable-eHealth systems, we developed a prototype as a Web-based EHR system. This prototype uses the Open Digital Rights Language (ODRL), a Digital Rights Management (DRM) technology capable of representing a wide range of policy-based information, for usage policy representation and manipulation. By storing the HCPs usage policy at the time of access as part of the transaction log, the system is capable of making context/situation-aware decisions.

The prototype system provides patients with the ability to set access policies on their HCPs, review access logs for their EHR information, submit inquiries for potential misuse, and review responses from HCPs. It provides HCPs with the ability

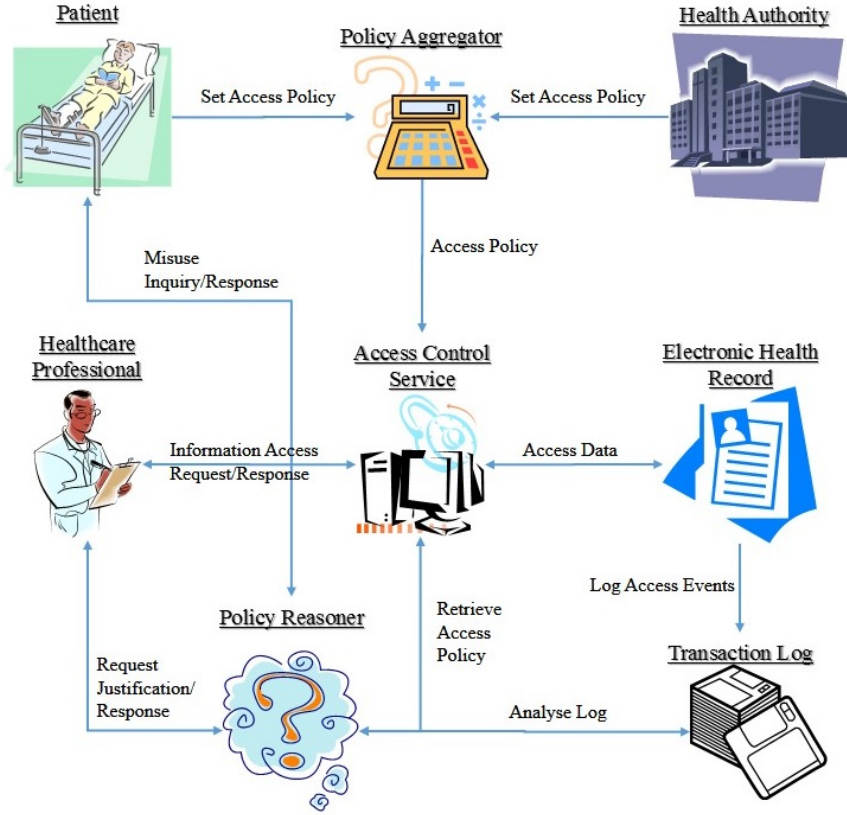


Fig. 1. AeH prototype architecture

to access their patients' EHR information, and respond to inquiries into potential misuse from their patient to justify their actions.

Information usage policies are defined by the patients according to their preferences including privacy requirements. These policies are aggregated with policies laid out by the Health Authority which ensure that the required information will be available to the relevant HCP. Patients have explicit control over which HCPs have access to their information. However, in circumstances where a patient's policy conflicts with that of the HA, the policies set by the HA will take precedence thus ensuring that HCPs can always access the necessary information without rigid barriers for the purpose of providing care to the patient. However, patients will still retain implicit control of their information through transparency of the actions of HCPs and the accountability measures put in place to assure appropriate use of information.

A semantic reasoner is used to make decisions regarding HCP responses to inquiries. This reasoner makes use of the context-aware transaction logs and rules defined by a Health Authority to determine if the reason given for a particular override of a patient policy is appropriate. In the event that it deems the information access as inappropriate, the patient is notified that it will be investigated and the Health Authority will be notified to investigate the situation to determine if there has been any misuse. Figure 1 shows the architecture of the AeH prototype.

In order to further establish the potential of AeH systems

to create useful shared eHealth records systems, we plan to integrate the AeH prototype with an existing EHR system, such as an openEHR implementation. Following this, we will perform a study to verify its suitability as a solution to balance consumer privacy and HCP information requirements through trials with both patients and HCPs.

### III. CONCLUSION

Accountable-eHealth systems enable the creation of shared eHealth records that can be useful to both patients and HCPs. By providing transparency and accountability to information access, patients are aware of how and why their information is accessed, while HCPs are able to access all the information they need to provide care to their patients.

Accountable-eHealth system have the potential to solve the information privacy conundrum, and enable improved healthcare through the high availability of clinical information. However, there is still much work to be done for Accountable-eHealth systems to be implemented.

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